



Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

John A. Scalice
Site Vice President, Watts Bar Nuclear Plant

FEB 20 1997

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

In the Matter of the) Docket No. 50-390
Tennessee Valley Authority)

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 FACILITY OPERATING
LICENSE NPF-90 - LICENSEE EVENT REPORT (LER) 50-390/97002 -
REACTOR/TURBINE TRIP DUE TO LOSS OF TWO MAIN FEEDWATER PUMPS

The purpose of this letter is to provide the subject report. The enclosed report provides details concerning the main turbine and reactor trip that occurred on January 22, 1997.

If you should have any questions, please contact P. L. Pace at (423) 365-1824.

Sincerely,

J. A. Scalice

Enclosure
cc: See page 2

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U.S. Nuclear Regulatory Commission
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cc (Enclosure):

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 AUTH. NAME AUTHOR AFFILIATION
 BROWN, R.M. Tennessee Valley Authority
 SCALICE, J.A. Tennessee Valley Authority
 RECIP. NAME RECIPIENT AFFILIATION

SUBJECT: LER 97-002-00: on 970122, reactor/turbine trip occurred due to
 loss of two main feedwater pumps. Mercoird level switch float
 assembly has been replaced. W/970220 ltr.

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1013. LICENSEE EVENT REPORT (LER)

(See reverse for required number of
digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20565-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

Watts Bar Nuclear Plant - Unit 1

DOCKET NUMBER (2)

05000390

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TITLE (4)

REACTOR/TURBINE TRIP DUE TO LOSS OF TWO MAIN FEEDWATER PUMPS

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
01	22	97	97	002	00	02	20	97		05000
OPERATING MODE (9)		1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)							
POWER LEVEL (10)		100	20.2201(b)		20.2203(a)(2)(v)		50.73(a)(2)(i)		50.73(a)(2)(viii)	
			20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)	
			20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71	
			20.2203(a)(2)(ii)		20.2203(a)(4)		X 50.73(a)(2)(iv)		OTHER	
			20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below	
			20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		or in NRC Form 366A	

LICENSEE CONTACT FOR THIS LER (12)

NAME

R. M. Brown, Licensing Engineer

TELEPHONE NUMBER (Include Area Code)

(423)-365-8195

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
B	SM	LS	M235	NO					

SUPPLEMENTAL REPORT EXPECTED (14)

YES
(If yes, complete EXPECTED SUBMISSION DATE).

X

NO

EXPECTED
SUBMISSION
DATE (15)

MONTH

DAY

YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On January 22, 1997, at 1350 EST, while the plant was operating in Mode 1 at 100 percent reactor thermal power in steady state producing 1208 MW_e, both turbine driven main feedwater pumps (TDMFPs) tripped on low turbine condenser vacuum. With both TDMFPs inoperable, the main turbine and reactor tripped at 1351. The Auxiliary Feedwater System automatically responded as designed to control steam generator levels and the plant was then stabilized in Mode 3. The TDMFP trip conditions on low turbine condenser vacuum were met after one of two TDMFP condenser drain tank pumps had been turned off at the local junction box with both TDMFPs running causing increasing fluid level in combination with a pre-existing failure of the TDMFP condenser drain tank level switch. The B pump handswitch had apparently been inadvertently bumped by a painter to the "off" position while working on the local junction box. Corrective actions consist of replacement of the failed level switch float assembly, review and replacement of similar float switch assemblies as necessary, installing protective covers over the turbine condenser drain tank pump local handswitches to prevent accidental operation, and conducting stand down meetings with applicable workers on configuration control expectations.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

I. PLANT CONDITIONS:

Watts Bar Nuclear Plant Unit 1 was operating in Mode 1 at 100 percent rated thermal power (RPT) in steady state producing 1208 MW_e.

II. DESCRIPTION OF EVENT

A. Event

On January 22, 1997, at approximately 1350 EST, while the plant was operating in Mode 1 at 100 percent RTP in steady state producing 1208 MW_e, both turbine driven main feedwater pumps (TDMFPs) (1-PMP-003-A and B) (Energy Industry Identification System (EIIIS) code SJ/P) tripped on low turbine condenser vacuum. With both TDMFPs inoperable, the main turbine (EIIIS code TG) and reactor (EIIIS code RCT) tripped at 1351. The Auxiliary Feedwater System (AFW) (EIIIS code BA) automatically responded as designed to control steam generator (EIIIS code SG) levels and the plant was then stabilized in Mode 3.

B. Inoperable Structures, Components, or Systems that Contributed to the Event

1. Main feed pump turbine condenser drain tank pump B (1-PMP-006-0220) (EIIIS code SM/P)
2. Main feed pump turbine condenser drain tank level switch (1-LS-006-0206 A/B) (EIIIS code SM/LS)

C. Dates and Approximate Times of Major Occurrences

January 22, 1997:

<u>Time/EST</u>	<u>Major Occurrences</u>
0900	Main feed pump turbine condenser drain collector tank pumps noted as running by (assistant unit operator) AUO
(Prior to) 1335	Turbine condenser drain collector tank pump B not running
(Prior to) 1335	Turbine condenser drain collector tank bypass valve (EIIIS code FCV) (1-FCV-006-0209) to condenser did not open
1335	Turbine condenser drain collector tank temperature started trending down at approximately the same time the turbine condenser drain tank handswitch control panel was being painted.

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II. DESCRIPTION OF EVENT (continued)

<u>Time/EST</u>	<u>Major Occurrences</u> (continued)
1350	TDMFP 1A condenser vacuum "Lo"
1350	TDMFP 1B condenser vacuum "Lo"
1351	TDMFP 1B tripped on low vacuum
1351	Standby main feed pump (SBMFP) (EIS code SJ/P) (1-PMP-003-0200) breaker closed
1351	TDMFP 1A tripped on low vacuum
1351	Turbine tripped
1351	Reactor tripped
Post trip	TDMFP turbine condenser drain tank pump B handswitch (EIS code HS) (1-HS-006-0220) discovered in the "off" position
	Water observed inside TDMFP turbine condenser drain tank level switch float assembly

D. Other Systems or Secondary Functions Affected

Other secondary plant equipment discrepancies were identified during the event evaluation that did not impact the reportable event. These have been documented in the Corrective Action Program for disposition.

E. Method of Discovery

The event was immediately monitored through control room indication as it occurred.

Post event investigation discovered equipment problems referred to in the report.

F. Operator Actions

The plant was stabilized in Mode 3.

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II. DESCRIPTION OF EVENT (continued)

G. Automatic and manual safety system responses

The initiation of AFW to maintain steam generator levels, the main turbine trip, and the reactor trip occurred as designed. All control rods inserted as required.

III. CAUSE OF EVENT

The cause of this event has been attributed to the failure of the TDMFP B condenser drain tank level switch and inadvertent shutdown of the TDMFP condenser drain tank pump B. Had the level switch functioned properly, annunciation would have been provided to the main control room, and the TDMFP condensate drain tank bypass valve (EIS code FCV) (1-FCV-006-0209) to condenser would have opened for bypass flow, allowing time for the placement of the condenser drain tank pump B back into service before TDMFP trip setpoints were reached.

The investigation revealed that both TDMFP condenser drain tank pumps were confirmed to be running at approximately 0900 hours by an AUO. At approximately 1335 hours, the TDMFP condenser drain tank temperatures started to trend downward concurrent with painting of the local junction box for the condenser drain tank handswitches. Interviews with the painter revealed that he was unaware of any change to the handswitch position during painting of the junction box. Further, the painter was knowledgeable of the sensitivity of handswitch position and the need to report any accidental configuration changes.

IV. ANALYSIS OF EVENT - ASSESSMENT OF SAFETY CONSEQUENCES

A. Evaluation of Plant Systems/Components

Condensate and Feedwater System

The condensate and feedwater system was operating normally prior to the event, with all secondary system pumps in service with the exception of the standby main feed pump which was aligned for standby operation. Due to a problem with the TDMFP condenser drain collector tank, the B TDMFP tripped on low condenser vacuum at approximately 13:51, followed by a trip of the A TDMFP on low condenser vacuum at approximately 13:51. This led to turbine/reactor trips and feedwater isolation on low T_{avg} . The SBMFP automatically started as designed. Auxiliary feedwater initiated automatically to maintain steam generator (SG) levels due to the trip of both TDMFPs.

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IV. ANALYSIS OF EVENT - ASSESSMENT OF SAFETY CONSEQUENCES (continued)

Heaters, Drains, and Vents System

This event was initiated from a malfunction of the heater, drains, and vents system. Condensate from the TDMFP condenser normally drains to the TDMFP condensate drain collector tank. Two pumps take suction from this tank with level control valves (EIS code LCV) in the pump discharge line controlling flow to maintain level in the tank. Both pumps are required to operate to maintain proper level in the tank when the plant is operating at 100 percent power with both TDMFPs in operation. Prior to 1335 hours on January 22, 1997, one of the two pumps was turned to the off position inadvertently. Level started to rise in the TDMFP condenser drain collector tank. Level switch (1-LS-006-0206A/B) failed to operate on high level as designed to open the TDMFP condenser drain tank bypass to condenser valve (EIS code FCV) (1-FCV-006-0209) and annunciate in the control room. Operations personnel were not alerted to the increasing level. Level continued to increase, filling the piping between the TDMFP condenser and the TDMFP condenser drain collector tank as indicated by decreasing temperatures of both TDMFP condenser drain lines. When the condensate backed up and started to cover the tubes in the TDMFP condenser, vacuum decreased in both the A and B TDMFP condensers. Vacuum decreased at about the same rate until both TDMFP condenser low level alarms annunciated in the control room. Steam flow to the TDMFPs was isolated on low vacuum resulting in a turbine and subsequent reactor trip. The loss of the TDMFP condenser drain collector tank pump in combination with the pre-existing failure of the TDMFP condenser drain collector tank high level alarm switch preventing the ability to automatically transfer TDMFP condenser drains to the main condenser on a high level resulted in a loss of TDMFP condenser vacuum. This condition resulted in trips of both TDMFPs, and the subsequent turbine trip and reactor trip.

B. Evaluation of Personnel Performance

Control room and shift personnel actions were appropriate and as expected. Plant procedures were followed, and operator control of the transient was fully adequate. The apparent inadvertent, undetected operation of the TDMFP drain tank pump handswitch is a personnel performance issue that contributed to this event.

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IV. ANALYSIS OF EVENT - ASSESSMENT OF SAFETY CONSEQUENCES (continued)

C. Safety Significance

A comparison of the event to the Final Safety Analysis Report (FSAR) was made. The loss of normal feedwater event, as described in the FSAR Sections 15.2.8.1 and 15.2.8.2, has an initial condition of 102 percent RTP. Other initial conditions are auxiliary feedwater (AFW) temperature of 120 degrees Fahrenheit (°F) with the two motor-driven AFW pumps supplying 820 gpm to the four steam generators (failure of turbine-driven AFW pump is assumed), and the secondary system steam relief is achieved through the self-actuated safety valves, assuming that the SG atmospheric relief and steam dump valves are not functioning. The figures listed in the FSAR (15.2-27A through 15.2-27I) assume a loss of off-site power for this transient since that case is more limiting. T_{avg} in the FSAR transient did not go below 565°F because of a large decay heat load and natural circulation occurring. The WBN transient T_{avg} went to 547°F. This reduced T_{avg} was expected because all three AFW pumps initially supplied approximately 56°F water to all four steam generators and flow was subsequently reduced per procedure to limit cooldown. Also, during the plant transient, both the steam dump system and the SG PORVs actuated. This limited the pressurizer pressure transient to approximately 30 psig increase instead of the analyzed value of 60 psig increase. The reactor trip system responded as expected with all control rods fully inserted. The review of this event shows that it is bounded by the loss of normal feedwater analysis discussed in FSAR Section 15.2.8.

V. CORRECTIVE ACTIONS

A. Immediate Corrective Actions

A team was assembled consisting of members of various plant organizations divided into a day and night shift to investigate this event.

B. Corrective Actions to Prevent Recurrence

The Mercoid level switch float assembly has been replaced.

A review has determined that a number of level switches with control and alarm functions are installed in secondary side applications. Preventative Maintenance (PM) instruction O-LS-002-0229A contains a list of twenty-two level switches controlled by float assemblies which are to be changed out every three years. Further review identified the critical components that could result in power reductions or reactor trips. One level switch application on the No. 7 heater drain tank (1-LS-006-190A & B) and its associated float was identified for further evaluation and was subsequently replaced. The other switches had previously been scheduled for change out during the second refueling outage.

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V. CORRECTIVE ACTIONS (continued)

B. Corrective Actions to Prevent Recurrence (continued)

Covers will be installed on the TDMFP turbine condenser drain tank pump hand switches (1-HS-006-0217 and -0220) to prevent accidental operation by May 7, 1997.

Stand down meetings have been held with appropriate workers on configuration control expectations.

The individual painter working at the handswitch panel no longer works at Watts Bar.

VI. ADDITIONAL INFORMATION

A. Failed Components1. Safety Train Inoperability

Main Feedwater System was inoperable due to trip of both TDMFPs.

2. Component/System Failure Information

a. Method of Discovery of Each Component or System Failure:

Trip of TDMFPs were annunciated in the main control room.

A post trip investigation team uncovered inoperable components associated with the condenser drain tank.

b. Failure Mode, Mechanism, and Effect of Each Failed Component:

The TDMFP B condenser drain tank level switch failed to indicate high level. Further investigation revealed fluid internal to the float mechanism. This fluid affected the switches ability to detect high tank level.

The condenser drain tank B pump was apparently inadvertently turned off. Thus, it is considered a personnel error and not a component failure.

c. Root Cause of Failure:

The level switch float mechanism developed a small leak. Water entering the float decreased the buoyancy of the float causing the level switch to fail to operate on high level as designed.

The condenser drain tank B pump handswitch was apparently inadvertently bumped to the off position by a painter working on the associated junction box.

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VI. ADDITIONAL INFORMATION (continued)

- d. For Failed Components With Multiple Functions, List of Systems or Secondary Functions Affected:

There were no component failures of this type.

- e. Manufacturer and Model Number of Each Failed Component:

Mercoid level switch model No. 211WT7806

B. Previous Similar Events

No other similar events have occurred at Watts Bar.

VII. COMMITMENTS

Covers will be installed on the TDMFP turbine condenser drain tank pump handswitches to prevent accidental operation by May 7, 1997.